INTIEL

PROGRAMMABLE DIFFERENTIAL THERMOSTAT
DT 3.4

USER MANUAL

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TECHNICAL DESCRIPTION

1. Application

Differential thermostat is integrated in systems for preparing domestic hot water into boilers, heated by combination by boiler, solar panels and electric heaters. Designed to manage the work of two circulation pumps installed in:

- Water circuit between the panels and serpentine the boiler;
- Water circuit between the boiler and the second serpentine of the boiler.

In this way regulate heat exchange therebetween.

It is possible to include a third pump to regulate the heat exchange between the solar panels and a second tank (buffer tank or pool).

2. Operation

The thermostat has four temperature sensors mounted respectively in the heater, solar panels and boiler. The process works with the following parameters:

2.1 **dT_1**, **Δt_1** - set and actual temperature difference between the panel and the boiler. dT1 can be set within the range of 2 to 20 °C. **The default setting is 10 °C**;

2.2 **dT_2**, **Δt_2** - set and actual temperature difference between the boiler and the heater. dT2 can be set within the range of 2 to 20 °C. **The default setting is 10 °C**;

2.3 **Tb_{set}** - set temperature in the heater to which it could reasonably be heated by solar panels, boiler, electric heaters. Set in the range of 25 to 90 °C. **The default setting is 60 °C**;

2.4 **Tb_{max}** - critical maximum temperature in the heater. Set in the range from 80 to 100 ° C. **The default setting is 95 °C**;

2.5 **Tb_{min}** - minimum water tank temperature below which the defrost is terminated on the panel. Do not set. **The default setting is 20 °C**;

2.6 **Tp_{min}** - minimum temperature of the solar panel. Set in the range from 20 to 50°C. **The default setting is 40 °C**;

2.7 **Tp_{max}** - maximum permissible temperature of the solar panel. Set in the range from 80 to 110°C. **The default setting is 105 °C**;

2.8 **Tp_{def}** - defrosting temperature of the solar panel. Set in the range from -20 to 10 °C. **Default without defrosting - -**;

2.9 **Tk_{set}** - boiler water temperature at which the pump 2 will turn without monitoring differential (only if the corresponding option is selected). Set in the range from 30 to 90 °C. **The default setting is 60 °C**;

2.10 **Tk_{min}** - minimum boiler water temperature. Set in the range from 20 to 50 °C. **The default setting is 40 °C**;

2.11 **Tk_{max}** - maximum boiler water temperature. Set in the range from 80 to 100 °C. **The default setting is 95 °C**;

2.12 **Tk_{def}** - temperature of the boiler water, under which is turn a pump 2 continuously the purpose to prevent freezing of the water in the pipes. Do not set.
The default setting is 10 °C;

2.13 $\mathbf{T_{buff}}$ - Set temperature to a second tank (buffer tank or pool) It is used only when it is selected Heaters Opt.3 (see point **4.2**). Set in the range of 25 to 90°C. **Default 40 °C**.

*- When any of the temperatures higher than +120° C and is not connected temperature sensor of the display shows "**hi**"*
*- When one of the temperatures is lower than -20 °C or has a bridged temperature sensor is displayed on the display "**low**"*

The operation of the thermostat is defined according to the status of the sensors as follows:

A) *Normal modes*

Conditions defining the operation of pump 1:

- At a temperature in the lower part of tank $\mathbf{Tb_1}$ lower than the set $\mathbf{Tb_{set}}$ and positive difference Δt_1 between the temperature **Tp** of the panel and the bottom heater, more than the set $\mathbf{dT_1}$ by 2 °C, is turn a *pump 1* is carried heating of heater from the panel. If in the process of heating the boiler $\mathbf{\Delta t_1}$ equals the set $\mathbf{dT_1}$, turns off *pump 1* (relay output 1)
- The heating is done until the temperature at the bottom of the tank $\mathbf{Tb_1}$ equals with set Tbset, then the pump is switched off;
- If the above conditions of the panel temperature drops below $\mathbf{Tp_{min}}$, the pump operation is prohibited, however, that there may be $\mathbf{\Delta t_1 > dT_1 + 2\ °C}$ and $\mathbf{Tb_1 < Tb_{set}}$;
- If the temperature of the solar panel drops below $\mathbf{Tp_{def}}$, *pump 1* turn on enforcement, although it was off because of temperatures below $\mathbf{Tp_{min}}$ (only if option enabled for defrosting);
- If the previous regime tank temperature drops under $\mathbf{Tb_{min}}$, the pump turns off, as is terminated defrost panel.

Conditions defining the pump 2 operation:

- At a temperature in the lower part of tank $\mathbf{Tb_1}$ lower than the setpoint and a positive difference $\mathbf{\Delta t_2}$ between the temperature $\mathbf{T_k}$ of the boiler and the lower part of the heater, more than the set $\mathbf{dT_2}$ by 2 °C, turn on a *pump 2* and is carried to the heating heater from the boiler. If in the process of heating the heater $\mathbf{\Delta t_2}$ declining, after $\mathbf{\Delta t_2}$ align the set $\mathbf{dT_2}$ turn off the pump (relay output 2);
- The heating is done until the temperature at the bottom of the tank $\mathbf{Tb_1}$ equals with setpoint $\mathbf{Tb_{set}}$, then the pump is switched off;
- If the above conditions, the boiler drops below $\mathbf{Tk_{min}}$, the pump operation is turn off, however, that there may be $\mathbf{\Delta t_2 > dT_2 + 2°}$ C and $\mathbf{Tb_1 < Tb_{set}}$;
- If the boiler temperature drops below $\mathbf{Tk_{def}}$, *pump 2* is force, although it has been turned off because of temperatures below $\mathbf{Tk_{min}}$.

Conditions determining the operation of electric heaters on the tank:

- If the temperature at the top part of tank $\mathbf{Tb_2}$ is lower by 15 °C than the set $\mathbf{Tb_{set}}$ is allowed heating by electric heaters to reach the $\mathbf{Tb_{set}}$ (relay output 3). Does this happen when there are no conditions for the pumps and heaters to work independent of the pump, select the option "*Heaters*" in the menu (see section **4.2**).

Conditions determining the operation of pump 3:

- With option *Heaters Opt.3* (see section **4.2**), the controller is configured to work with a third pump that is connected to the relay output 3 instead of electric heaters and $\mathbf{Tb_2}$ sensor is mounted in the second tank
- At a temperature $\mathbf{Tb_2}$ in the second heater below the setpoint $\mathbf{T_{buff}}$ and panel temperature **Tp**, as well as a positive difference $\mathbf{\Delta t_3}$ between the temperature Tp of the panel and the second heater, larger than the set $\mathbf{dT_1}$ by 2 °C, turn on a *pump 3* . But only in cases where there is no running pump 1;
- Heating is performed while the temperature $\mathbf{Tb_2}$ equals the set $\mathbf{T_{buff}}$, then the pump is switched off;
- If the conditions for their turn on of pump 1, work *pump 3* is terminated.

In this way the heating of the first heater is given priority.

B) Alarm Modes

- If in the process of heating the heater, the temperature of the panel exceeds $\mathbf{Tp_{max}}$, *pump 1(and the pump 3 if used)* will be forced the purpose cool the panels. This is done despite the temperature at the bottom of the tank $\mathbf{Tb_1}$ can exceed $\mathbf{Tb_{set}}$.
- If in the process of heating the heater, the temperature of the boiler exceeds $\mathbf{Tk_{max}}$, *pump 2* (and the pump 3 if used) is force for cooling of the boiler. This is done despite the temperature at the bottom of the tank $\mathbf{Tb_1}$can exceed $\mathbf{Tb_{set}}$.
- If, at the above conditions temperature in the lower part of the heater reaches the critical maximum value $\mathbf{Tb_{max}}$, *pump 1* is turned off, although this may result to overheating of the panel. *In this way the temperature in the boiler has a higher priority to the temperature of the panel.*

In this case operation of the *pump 2* also terminate.

When using a third pump, it is switched off when the temperature of the water in the buffer vessel reaches $\mathbf{Tb_{max}}$.

3. Front panel

On the front panel are the control elements and programming. These are graphical LCD display, LED display and three buttons - button *up*, button *down* and button *"SET"*. Appearance of the front panel is shown in Figure 1.

Figure.1

3.1 Graphic LCD display with a resolution of 128x64 pixels (1) - provides information on the current temperature measured by the sensors **Figure 1.1a**, state information system shown by icons **fig.1.1b** (see *Table 3*) Ability to adjust the controller by user menu **fig.1.1c**;

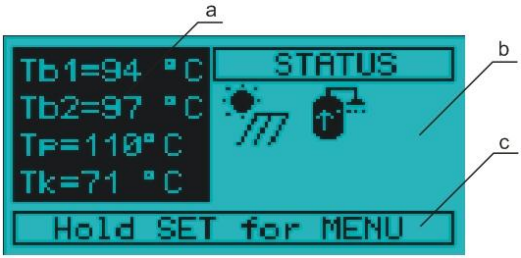


Figure 1.1a

3.2 LED (2) - indicates abnormal conditions;
3.3 Buttons (3) - buttons to adjust the controller.

4. Programming

After power supply the thermostat automatically established reset, which shows the temperature the tank, solar panel and boiler and system status by icons.

4.1 *Enter the menu of the controller*

By pressing and holding the *"SET"* button for more than 3 seconds. With the up and down to navigate forwards and backwards in the menu. Change the selected item by pressing of a button *SET*. A when the value is changed after pressing the button *SET* value start flashing, changing it is done by pressing up or down. Confirm the selected value - again with *SET*.

4.2 *Options*

- ***Vacation***. On and off mode "Vacation." Mode is designed for cases where tank is not used for a long time. When activated, the temperature of the water heater is set at 40 ° C and the inclusion of electric heaters is terminate. Pump 1 turns as necessary in order avoid overheating the water heater or the panel. This mode does not affect the operation of the pump 3, where the controller is used with the selected option - Heaters Opt.3;

- ***Pump 2 ON***. With option dT2, management of pump 2 becomes differential temperature between the water heater and the boiler. With option Tkset, pump 2 turns following an assigned temperature, without monitoring the differential difference;

- ***Heaters***. When selected, Opt.1, electric heaters switch when no pump running for more than 15 minutes and compliance with the conditions of point 2.

When selected, Opt.2 heaters shall switch on independently of whether they have turned a pump, as long as the conditions specified in point 2.

When selected Opt.3 electric heaters are not used. In this case Tb2 sensor can be mounted in the second boiler, buffer tank or pool and to relay output 3 to include a third pump to the solar system;

- **Freez Def**. Enables or disables the function for defrosting the panel;

- **Default data**. Returns the default set of manufacturer;

- **Save & Exit.** Save Settings from the menu. When not changed settings is done only output from the menu.

If a period of 15 sec. no buttons are pressed, it should automatically exit the menu, as the changes are **not saved in memory. In this case they will be valid until it is stopped power.**

5. Electrical connection

Electrical connection involves connection of sensors, mains power pumps and electrical heaters, according to Figure 2. The sensors are a type Pt1000 .

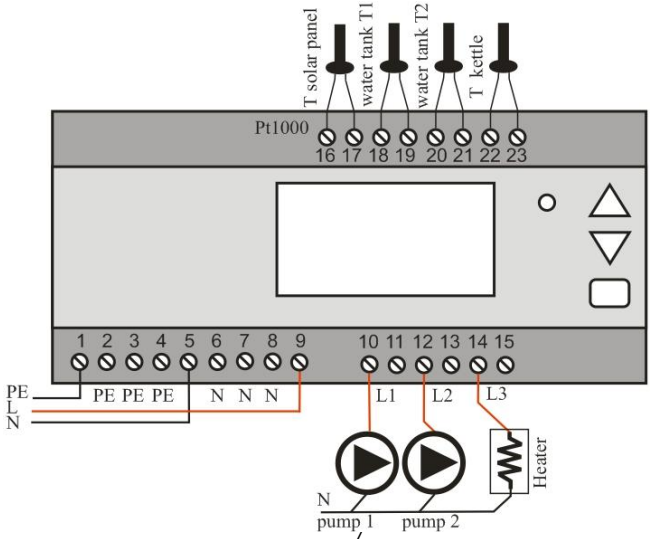


Figure 2

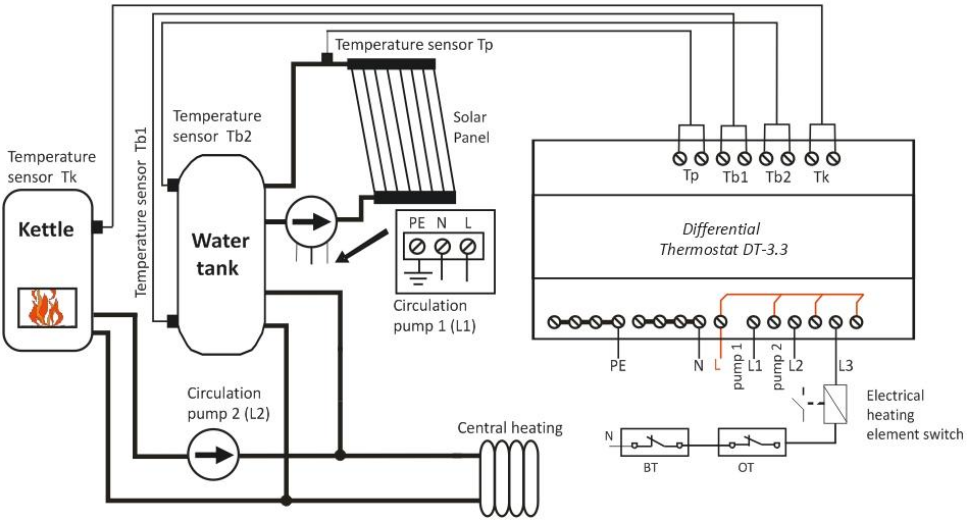
If necessary connecting cables of the sensors can be prolonged.
Recommended length that does not affect the measurement is to **100m**.

Terminals 16, 17 are input to the sensor in the solar panel.
Terminals 18, 19 are input to the sensor at the bottom of the water tank.
Terminals 20, 21 are input to the sensor on top of the water tank or secand water tank or swimming pool.
Terminals 22, 23 are input to the sensor in the boiler.
Terminals 1 ÷ 4, 5 ÷ 8 and 9 shall be conected accordingly protective ground zero phase power supply.
At terminals 10, 12 and 14 are respectively connected to pump 1, pump 2 and the electrical heaters, which starting phase (L1, L2 and L3). At terminals 11, 13 and 15 out phase (L1, L2 and L3), when terminals 10, 12 and 14 not out and vice versa.

6. Hydraulic connection

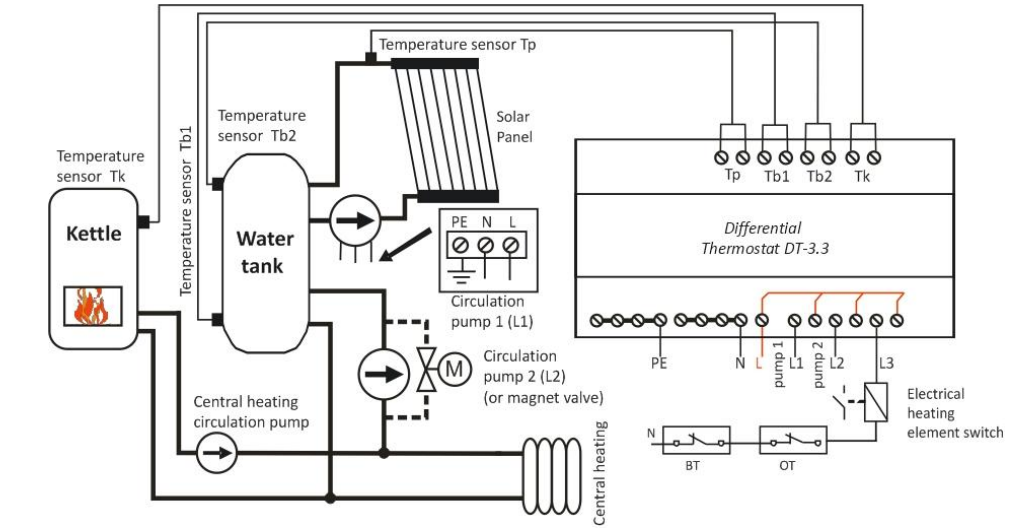
Example of a system with one heater, system with 2 tank (buffer tank, swimming pool). Heated by solar panels, boiler and electrical heaters.

A) Heatingt water tank with boiler, solar panels and electric heaters. With a common pump tank and heating.



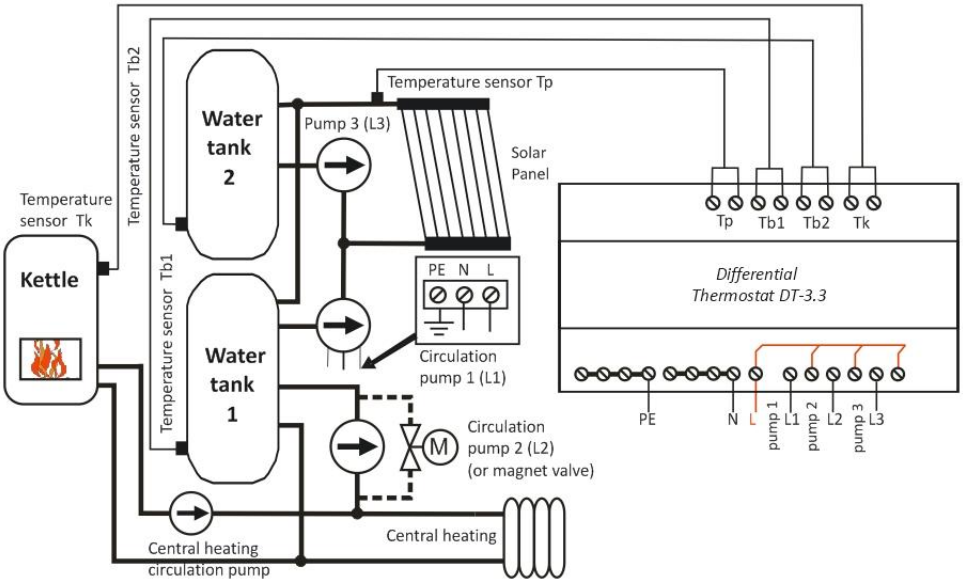
PT - working heater thermostat
BT - block heater thermostat

B) With two pumps for water tank and heating. Rather than pump 2 can be installed solenoid valve or a two-way valve with motor actuator:



PT - working heater thermostat
BT - block heater thermostat

C) Heating a second heating boiler, electric instead electric heaters mounted a third pump:



7. Technical data

Rated supply voltage	~ 230V/50-60Hz
Rated current commutated	7A / ~ 250V / 50-60Hz
Number of output contacts	three switching
Differential temperature	2 ° - 20 ° C
Sensors:	Pt1000 (-50 ° to +250 ° C)
Current through the sensor	2,6 mA
Measuring range	-20 ° to +120 ° C
Indication graphical	LCD display
Measurement unit	1 ° C
Humidity	0 - 80%
Level of Protection	IP 20

Table 1

P A R A M E T E R S				
indication on the display	***description***	***range***	***default setting***	***the user setting***
dT_1	Setpoint the temperature difference between the panel and the water tank.	2 ÷ 20°C	10° C	
dT_2	Setpoint the temperature difference between the boiler and the water tank.	2 ÷ 20°C	10° C	
Tb_{set}	Setpoint water tank temperature to which it can normally be heated by solar panels and boiler	25 ÷ 90° C	60° C	
Tb_{max}	Critical maximum temperature in the heater. A lso for the buffer, if used.	80 ÷ 100°C	95° C	
Tb_{min}	Minimum water tank temperature below which the defrost is terminated on the panel.	not set	20° C	
Tp_{max}	Maximum temperature of the solar panel.	80 ÷ 110°C	105° C	
Tp_{min}	Minimum temperature of the solar panel.	20 ÷ 50° C	40° C	
Tp_{def}	Temperature at which defrost allows the solar panel.	-20 ÷ 10°C	--	
Tk_{set}	Setpoint boiler water temperature to which is operated pump 2	30 ÷ 90°C	60° C	
Tk_{max}	Maximum boiler water temperature	80 ÷ 100°C	95° C	
Tk_{min}	Minimum boiler water temperature	20 ÷ 50° C	40° C	
Tk_{def}	Protective boiler temperature below which turn on a pump 2	not set	10° C	
T_{buff}	Setpoint temperature for the buffer or pool (only used when - Heaters Opt.3)	25 ÷ 90° C	40° C	

Table 2

OPTIONS			
indication on the display	*description*	*default setting*	*the user setting*
Vacation	Mode "Vacation."	OFF	
Pump 2 ON	The turn on of the pump 2 will be made by: dT2 - differential; Tkset - set boiler water temperature.	dT2	
Heaters Opt.	1) electric heaters turn on when the pumps are not working; 2) are turn on regardless of pumps; 3) Opt3-heaters are not used, the output is used for the third pump.	Opt.1	
Freez Def.	Frost protection of solar panels	OFF	

Table 3

ICONS	
image	*description*
	Function antifreeze is activated
	Overheating of the solar panel
	The temperature in the tank is above the maximum
	Temperature in the boiler is above the maximum
	The temperature in the boiler is below 10 ° C
	turned electric heaters
	turned Pump 1
	turned Pump 2
	turned Pump 3
n/a	no Pump 3 is ised

Notes:_____

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7. Warranty

The warranty period is 24 months following the purchase date of the unit or its installation by a qualified staff, but not exceeding 28 months after the production date. The warranty is extended to the malfunctions that occur during the warranty period and are result of the production reasons or defective used parts.

The warranty does not relate to malfunctions corresponding to not-qualified installation, activities directed to the product body interference, not regular storage or transport.

The repairs during the warranty period can be done after correct filling of the manufacturer warranty card